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CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

SCIENTIFIC, TECHNOLOGICAL REVOLUTION AND PROFILE OF THE SPECIALIST--PERSONNEL FOR MACHINE PROCESSING OF ECONOMIC DATA

Moscow VESTNIK VYSSHEY SHKOLY in Russian No 8, 1977 pp 29-34

[Article by Doctor of Economic Sciences, Professor V. V. Shurakov, rector of the Moscow Institute of Economics and Statistics]

[Text] The party and government give special attention to the problem of accelerating scientific and technological progress in all areas of the national economy and increasing the effectiveness of social production as the main direction of economic development of the country. Its practical realization requires improvement of the system of management with use of contemporary computer technology and the development and application of methods of mathematical economics. Also needed, of course, are specialists capable of processing the information.

The basic VUZ in the area of preparation of such specialists (with the profile "Organization of the machine processing of economic data" -- 1738) is the Moscow Institute of Economics and Statistics, which since 1949 has prepared such personnel in all its departments -- the day, evening and correspondence courses. During that time over 10,000 economic engineers have been graduated, organizers of the machine processing of economic data and creating and operating automatic control systems.

A conference of chairmen of the corresponding profiling departments of all the VUZ's, conducted by the institute in February of this year, was devoted to problems in the preparation of contemporary specialists in the machine processing of economic data. Represented at it were 38 VUZ's and also ministries and departments "requiring" such specialists. We will select the most important of a large number of discussed problems.

The first problem and a fundamental one is the model of the specialist.

To develop and introduce data processing systems the specialist must above all thoroughly understand the principles of the organization and economics

of contemporary production, completely master his specialty and be able to evaluate a large number of events in a system and make decisions on the basis of that analysis. On the other hand, it is necessary to clearly define the functions of each specialist working in the area of automatic control systems and as early as in the stage of planning clearly perceive the character of his activity and interaction with other specialists in the process of solving administrative tasks. Many questions arise which relate to determining the profile of preparation of administrative personnel and to forming in them the required system of necessary knowledge, abilities and skills.

It must not be forgotten that the requirements for specialists will grow with each year. For example, a mathematician participating in the development of ACS is now obliged not only to master a complex of skills of machine solution of problems in the theory of operations research but also to be able to effectively analyze systems and simulate them with a computer and also to have professional training in the area of the theory of complex systems and a specific economy. And, shall we say, the developer of ACS must know the economics of an enterprise, know methods of optimizing solutions, know how to formulate a problem, construct a mathematical model of it, etc. But the head of a subdivision operating ACS needs, in addition, knowledge of psychology, sociology, economics and the history of science and technology; to a certain degree he must also know foreign languages, to become acquainted with foreign experience.

Of course, the concept of which knowledge is needed by the economic engineer with the profile of interest to us and what practical experience he must have has already formed. However, in the preparation of educational plans and programs for specialty 1738 one must face a number of difficulties caused above all by the specific nature of the VUZ's (technical and in the humanities), the character of the experience accumulated by them and the presence of a technical base. All these problems were discussed at the mentioned conference. Its participants adopted in the main the approach proposed by the Moscow Institute of Economics and Statistics, which we intend to describe.

The given approach to construction of the model of the specialist is formulated with respect to three main sections: "He must know," "He must master" and "He must be able." These areas are presented in three tables, the degree of detail of which makes it technically impossible to present them in a journal article. But since it is precisely the detailed development of the three mentioned sections which forms, strictly speaking, the basic, principal essence of the work done in the institute, we will attempt here to reveal its content with the greatest possible degree of detail. Unfortunately, in so doing we will not succeed in avoiding some monotonous listing of questions and themes addressed only to the professionally interested reader.

And so the section "He must know" contains in general a listing of knowledge comprising the basis of the specialty, and also a list of the legislative acts, statutes, instructions and other guiding and normative documents with which the specialist must be familiar. The most general of the questions considered here are combined in four groups: general methodological, of ACS planning, of functioning of the object and of mathematical methods.

General methodological questions are general questions of the economics of socialism and decisions of directive agencies on questions of economics: the principles of the economics and organization of production and administration; the basic principles of the organization of production and administration at the enterprise and in the branch; decisions on questions of the planning and creation of ACS and effective guiding and technical materials on those questions; the methodology of ACS planning; the state, technical level and characteristics of ACS developed and being developed in our country and abroad, and experience of scientific collaboration in that area with countries of socialism. Among the questions of ACS planning is work done on the object of its creation, the general structure of an ACS, the main distinctive features and characteristics of its subsystems and several additional points relating to any practical manner of assuring it -- organizational, technological, mathematical, legal, etc. By the functioning of the object are understood the basic principles of management of an enterprise and their content; the role and place of the enterprise in the system of the national economy; its interrelations and connections with management agencies; the general technical and economic indicators of an enterprise and branch and its specific features; the principles of the technology of production; the theoretical principles and distincitve features of production of the branch; and analysis of the functioning of the enterprise. Of course, in speaking of mathematical methods we have in mind the principles of information theory and its applied methods; mathematical methods of operations research and their possibilities; methods of gathering and processing experimental data; the theory of data processing; standard procedures and processes of data processing; methods of preparation and decision making and the mathematical apparatus for evaluating the effectiveness of ACS introduction.

This necessary volume of knowledge we consider a potential conditions for successful activity of a specialist at the work-place, a condition necessary but insufficient -- knowing how to apply that knowledge in practice also is required. The following two sections also correspond to these requirements.

In the section "He must master" are defined the skills needed by the specialist to solve tasks in the system approach to a situation, and also that professional terminology, skills, methods and working procedures and behavior which are acquired and formed in the process of instruction within the walls of the VUZ itself, in production and pre-certificate practice and in the course of probation at the work-place. Here we consider it appropriate to emphasize that the mastering of practical skills for a specialist with our profile means that he follows not so much the course of performance of the action as its results.

And so the necessary methods are those of a systems approach to work on the creation of ACS, leadership of the collective of workers, the statement of one's own opinion, estimation of the realizability of the ACS in terms of behavioral and economic variables, economic analysis of the functioning of data processing systems and evaluation of adopted decisions, preliminary estimation of the realizability of the applications of computer technology and estimation of the functioning of the organizational structure of the system.

Among the methods which a graduate ought to be master of are methods of estimating the technological level of created ACS at enterprises and in branches of the national economy; the use of the methods of mathematical economics; doing research and planning work; economic analysis of the distribution of resources; definition and description of any situation or system; the formation and solution of very simple models of operations research and the distinguishing of models for frequently encountered situations.

Skills which the specialist must be master of are: doing research in the specialty; the systems approach to questions in ACS construction; work with the scientific and technical literature on specialized and related questions. In addition, it is necessary to listen attentively to the opinions of others and to determine the informational needs of persons in positions in each functional area and a number of other matters.

Finally, reflected in the section "He must be able" are the main functions performed by specialists, and also their ability to apply obtained knowledge in practice. We think that practical skills and abilities are developed in direct unity and interrelation; the level of professional mastery and the professional level of the specialist are also determined by the perfection of the mastery of those skills.

If the content of this section is deciphered, it is a matter here of four types of functions: organizational analysis and investigation, methodical and working. The specialist must be able to organize the planning and complex examination of the enterprise and lead such an examination; to determine the measures necessary for preparation of the enterprise for the introduction of an ACS and its separate tasks and subsystems; to designate and implement the development and realization of progressive and prospective directions in the creation of an ACS; to evaluate the directions of technical progress; to determine the main directions in ACS development. The analytical skills of a graduate in a given specialty consist in the ability to determine the specifics of the activity of an enterprise; general economic and organizational problems of enterprise management; to determine the scientific and methodical level of the ACS being developed; to compile a report on planned servicing; to monitor the technical level of the ACS and to experimentally estimate the correctness of adopted decisions. Finally, we will list methodical and working abilities -- both of them have been formulated by us in six points. The methodical are: to provide methodical leadership and coordination of work on the creation of the ACS; to prepare a program of investigation of the enterprise (or the branch); to accomplish scientific and methodical leadership of the development of a specific ACS; to develop methodical materials on its creation; to extend practical and methodical help on various questions in the development and introduction of the ACS, and to hold consultations and lecture on these questions. The working abilities are: to develop a technology for management of the enterprise; to set tasks of management in connection with the compilation of algorithms of solution; to estimate the data flows; to prepare separate sections of technical and working plans of the ACS; to compile a technical task on the development of the ACS, and to consider and monitor work on the creation of the ACS both in the organization and at the customer's place.

The presented scheme, in our opinion, establishes the qualification requirements for those taught, the place of the young specialist in the organizational structure of the enterprise or institution, his functions and the content of the work, the required personal qualities and also the objective conditions necessary for his successful execution of his duties. Of course, the proposed structure of qualification requirements is open to supplementation and improvement. However, the approach implemented in the Moscow Institute of Economics and Statistics has already made it possible to create (and firmly establish) a new standard educational plan and programs of discipline.

The following consideration is the starting one for the construction of an educational plan: a graduate in specialty 1738 must be so trained that, upon arriving at a production facility, he can at once proceed to work and will have the basis for subsequent professional work. The knowledge and capabilities necessary for efficient work can be roughly characterized as those obtained by integration of basic concepts relating to the collective in which the graduate works, the organization for which the ACS is developed, and the models, systems and data processing technology.

The enumerated knowledge and capabilities can be verified during laboratory work, the defense of course projects, in tests and examinations and by means of other test measures. Since besides knowledge it is very important for the specialist to acquire experience of action in situations resembling the working situations, special attention should be concentrated on practice -- technological and undergraduate. The following measures should be implemented here: the gathering of data in a real organization; operations research done jointly with specialists and connected with the modeling of complex situations; work as a probationer or full member of a group of designers of data processing systems; performance of the duties of a member of a group of programmers creating a given programming system; participation in the discussion of the basic principles of developed plans.

The content of the disciplines presented to students must be carefully thought out from the point of view of correspondence to the above-enumerated goals of the educational plan. When they have been formulated, those goals can also serve as a reference point for the scientific and methodical work of the instructors.

The second problem is the reception in the institute of well-prepared matriculants, and the ACS-MIES, in particular, such subsystems as "The matriculant," "Examination" and "Analysis," helps fairly effectively to solve that problem in a scientific manner. With their help the functions of objective selection of matriculants was re-placed on the "reliable shoulders" of a computer. At the same time the labor-intensiveness of the processing of information on the issuance of examination tasks, their evaluation and the selection of optimization solutions of the process of enrolling matriculants has been sharply reduced. How this is done has been discussed in detail in the articles of V. V. Shurakov and I. G. Venetskiy in issue No 6 of the journal in 1972 and of I. G. Venetskiy and N. Sh. Kremer in No 4 of 1977.

The creation of the necessary conditions for constant improvement of the educational process is the third problem. If an analogy is made with industrial production, its solution can be represented as the organization of technological processes on the basis of the latest achievements of science and engineering. What does this mean, however, from the point of view of the VUZ?

Analysis of the practical activity of our young specialists confirms that to work completely professionally from the very start they must above all have fundamental methodological training -- must be thoroughly familiar with Marxist-Leninist economic theory, specific branches of economics and mathematics and contemporary computer equipment. However, if one holds to the analogy with the national economy, it is very important in preparing the educational plan to take into consideration the prospects of practical activity of the specialists in the next 5-10 years. This is why our new educational plan, compiled by a collective of leading scientific-educational workers jointly with eminent scientists and practical workers, is oriented toward the fundamental study of economic disciplines and contemporary mathematical apparatus, prospective directions of the development of computer technology, the theory and organization of machine data processing, computer software and ACS. A merit of that educational plan is that it has a built-in "reserve" of time for the introduction, upon resolution of the VUZ council, of new scientific disciplines which appear.

Much remains to be done to improve the educational process in the area of creation of educational literature. True, all disciplines of our educational plan now are in the main provided with the necessary textbooks and manuals. In proportion to the working up of the plan it is necessary to follow carefully the creation and renewal of textbooks and manuals and methodical developments for laboratory courses for which a need periodically arises. And the attention of the principal scientific educational forces of the VUZ's must also be riveted on that matter.

We consider the fourth problem in importance to be assuring connection of the educational process with transitional production and scientific collectives and with agencies of management, above all to make sure student course and certificate projects are realistic. From those positions it is necessary to improve also the organization of productive practice. And to do that it is necessary to strive for the development of the most urgent scientific and practical problems on the basis of collaboration of VUZ instructors with the workers of science and production.

Experience testifies that the connection of the VUZ with enterprises where students do practical work as a rule is temporary and cyclical and ends as the practical work is completed. In the process of work the probationers as a rule are engaged in gathering material for their projects; student developments do not always find application at the enterprises. To us it seems very important for the improvement of practice in this direction to arrange the work of students in such a way that it is subordinate to the plans of the collectives where the students work and find practical realization there.

Let us note in passing that in recent years the organization of the productive training of students in problem and branch research laboratories of our institute has been constructed in precisely such a manner. Each course or certificate project is part of the planned work of the laboratory, and in it individual questions of data processing and the computer solution of various problems are worked out. An example is the wide participation of senior students in the planning and introduction of the ASC-MIES. Of course, that experience requires further improvement.

A very urgent and the fifth problem is elevating the level of research done in the VUZ, its interconnnection with the educational process and the development of the scientific work of students. This is a complex and multifaceted problem. Naturally, the main structural subdivision in the organization of all types of scientific activity and the assurance of its interconnection with educational and methodical work is the department. But no small role belongs also to the scientific laboratories of the institute, especially in recent years. There already is experience in the working out of individual themes in which instructors of the faculty, associates of the problem and branch laboratories, graduates and undergraduates participate. However, we still must be concerned about the further development of complexity of interdepartmental research work using the laboratories of the institute and other scientific and planning organizations as a base. Only in that way can important results be achieved and introduced into production: only in that case can they be successfully reflected in the educational plans and programs of the disciplines studied by students.

The profiling of departments and laboratories and the reinforcement of creative relations with related organizations and enterprises -- these, in our view, are necessary prerequisites for solution of the set tasks.

The sixth problem is, in essence, a continuation or development of those already mentioned. It is the constant reinforcement of the material and equipment base of the VUZ.

Life dictates the need to prepare specialists in a practical manner on the basis of contemporary and prospective means of computer technology. However, some departments of some VUZ's still do not have third-generation computers. We are obliged to assure broader access of students to computers in a dialog regime and create course and certificate planning offices equipped with terminals necessary for the experimental debugging of problems solved by computer. We can also classify as such also questions of the further development of the material and equipment base of the institute as the formation of the library stocks with new Soviet and translated publications and developments of scientific and planning organizations in the area of ACS and software.

The training and retraining of instructors is the seventh problem on the list but not in importance. In our institute it is solved, so to speak, internally and externally.

Internally means that systematically, at least once in 5 years, each instructor raises his qualifications at the Institute for the Improvement of

Qualifications or the Faculty for Improvement of Qualifications or becomes a trainee of a scientific research institute, VUZ or leading enterprise. We think that in connection with the rapid progress of computer technology the advisable period of probation of instructors of profiling and related departments is once in 3 years.

As has already been said, our institute is the basic one for the given specialty, and in its Faculty for Improvement of Qualifications about 300 instructors from other VUZ's have undergone training in the last 3 years alone. The dean of the faculty is seriously concerned about making up complete classes in time; he does much edicational and methodical work. Classes in the faculty are conducted by the most experienced professors and associate professors. The institute must improve this section of the work.

We have dwelt, as we said in the beginning, only on the main problems discussed at the conference, but it is precisely their solution, in our opinion, which will help prepare specialists meeting the present and prospective requirements of the national economy. There is no doubt that regardless of that it is necessary to have day-by-day improvement of the educational programs and procedures of instruction and the conducting of investigations in new areas of knowledge. No less important is painstaking educational work of VUZ's in accordance with the tasks set by the 25th CPSU Congress.

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TRAINING PERSONNEL FOR COMPUTER-AIDED DESIGNING

Moscow VESTNIK VYSSHEY SHKOLY in Russian No 8, 1977 pp 34-38

[Article by Doctor of Technical Sciences, Professor G. N. Solov'yev, Moscow Engineering Physics Institute (MEPI)]

[Text] Over 30 years have passed since the first appearance of computers with programmed control. Originating from a need to automate the solution of mathematical and computational problems, they later found wide application in various areas of science, technology and the national economy, in systems for the automatic control of technological processes and autonomous objects. In recent years the use of computers in automatic systems for the control of production and the management of enterprises and branches has been discussed often. A new area of application of computers has already formed -- automatic designing systems or computer-aided design. Such systems are being intensively developed and introduced in machine building, radioelectronics, construction and other areas of the national economy. The leading organizations have already long used them in the designing of computers.

Contemporary automatic designing systems accomplish various computational procedures connected with the calculation and optimization of designed articles and with the solution of problems of scientific and technological forecasting. In the ideal case such systems are supposed to work in time-sharing conditions and their hardware and software ought to be accessible directly from the workplaces of designers. The realization of such systems requires corresponding hardware and system programs. The hardware is above all multi-program computers, in the ideal case working in time-sharing conditions, and also general-purpose and specialized peripheral equipment; the software consists of operating systems assuring the functioning of hardware in time-sharing conditions and in conditions of dialog of the designer with the machine. This also includes system programs for the automation of the supplying of information, including data banks and files of users. All that has been said applies to automatic designing systems for any branch or department.

Besides that, hardware for automatic designing systems, some machine designing subsystems have already been formulated and are being effectively used in

various areas of the national economy. They include a graph machine used to draw parts, units of machines and designs of parts; automation of the designing of radioelectronic apparatus which assures a solution of such tasks as the analysis of electronic circuits, layout, the designing of standard replacement elements, etc. Such universal subsystems require the development of specialized languages and translators corresponding to them, and very specialized peripheral equipment, in a number of cases combined with small computers.

The presented list of subsystems is not complete. Other general-purpose subsystems undoubtedly will appear in the long-range future. Subsystems for the automatic designing of technological processes should be included in them.

Realization of machine designing systems also requires the development of narrowly specialized programs for the design of parts, optimization of the parameters of parts being designed and technological processes, the creation of programs for the designing of optimal designs, etc.

Specialists are need to solve all the enumerated problems. The training of machine designing engineers is basically similar to the educational system for specialists in computers. At the start of the 1950's the latter were trained in two directions: the training of engineers for the designing, development and operation of computers; all VUZ graduates were taught the principles of present-day computer technology and how to use it in their practical work. Those two directions are also characteristic of the training of specialists in machine designing.

The first direction here is the training of engineers in the designing, development and operation of automatic designing systems. It is a matter of specialists identically qualified in the area of systems engineering and systems servicing of automatic designing systems. Such specialists must exhaustively know the structures and characteristics of modern computers; the making of complete sets of computers in systems; and peripheral (general-purpose and specialized) equipment; that is, their knowledge must be sufficient for the competent substantiation and development of automatic designing systems, depending on the specific purposes, conditions and limitations. Those specialists must completely master programming in ASSEMBLER (the basic language for the development of system programs) and algorithmic languages of the type of FORTRAN, ALGOL and PL; they must have knowledge of operational systems of multi-program computers and systems programming necessary for the independent development of various specialized system programs. The concluding cycle of knowledge of these specialists ought to reflect the principles of automatic designing systems, the modeling and informational servicing of the automatic designing system, specialized languages and translators and the general-purpose subsystems of the automatic designing system.

It is already possible to profile such specialists now in departments working according to the individual educational plan of the specialty "Electronic computers" (0608). The educational plan for most departments training specialized engineers in that profile already now assures the training of

specialists in the area of hardware and system programming, including operational systems. A number of such departments have already produced for a number of years, in addition, exhaustive information about the automation of computer designing, a large portion of which is the basis of the subsystem of automated designing of radioelectronic apparatus.

Time for studying questions directly related to automatic designing systems can be obtained as a result of curtailment of the disciplines of the given specialty connected with study of similar computers, questions of the designing of circuit technology, processors, memories and the design and technology of production of computers.

Side by side with the given specialization, a graduate of which can successfully work in any branch of the economy, specialists on automatic designing systems also are necessary in various branches, each of which has its specific features. Questions regarding research and the substantiation and development of special methods, algorithms and programs for automatic designing must become the basis of the education of such specialists.

The training of specialists of these two groups will give the country theoreticians, developers and operators of automatic designing systems, and that will help to create real automatic designing systems and contribute to their wide use.

The second direction is teaching the principles of modern automatic designing systems to all graduates of higher schools who have some relation to problems of designing. They all must be completely familiar with the possibilities of such systems at the present time and in the future and obtain valid knowledge and skills in their use. And to do that, all the training profiling them must be oriented toward the obligatory and wide use of automatic designing systems.

Side by side with the formation of a profiling cycle of lectures, the principles of which were presented above, the organization of laboratory and practical courses on automatic designing systems is very labor-consuming. The basis of a practical course in an ideal case would be a time-sharing system with a number of terminals in the form of an automated work-place, which includes a graphic display and a graph constructor or other specialized peripheral equipment. One does not count on equipping the VUZ's with such equipment in the very near future, of course, but one can use for those purposes hardware available in the VUZ's, in particular, small models of the ES system and the "Minsk-32," which make it possible to execute tasks in packet conditions. In that case each student performs tasks on automatic designing independently -- in obligatory courses on description under the supervision of an instructor. The performed tasks are processed in packet conditions and the results issued later by the computer are discussed at the following class. The basis of such classes are programs of automatic designing subsystems. Those programs are prepared by co-workers of the department, or the software of specific subsystems used in design offices, scientific research institutes and other organizations will be used for that purpose. The programs developed by co-workers of the department are, as a rule, somewhat limited in their possibilities, but

in turn they completely match the parameters of the used computers and are methodically perfected. The programming, however, taken in the scientific research institutes and design offices, if it proves compatible with the characteristics of the hardware used in the VUZ, then, as a rule requires substantial methodical refinement. This is testified to by the experience of the Electronic Computers Department of the Moscow Engineering Physics Institute, which is realizing both those methods in the organization of laboratory courses on "Automation of Computer Design." Here an M-220 machine is used for the system of automated logical designing of electronic circuits developed in the department, and the programming for automation of the designing of standard replacement elements and the solution of the layout task on an ES-1020 machine, programming borrowed from one of the scientific research institutes.

The main content of such a laboratory practical course can be effectively used also in a subsystem for automation of the designing of radioelectronic apparatus, for students specializing in electronics.

VUZ's which have ES machines and the "Minsk-32" can start to create a subsystem for the automatic manufacture of drawings, with subsequent development of that system to the point of fulfilment of the functions of automatic designing by it. But for that purpose it is necessary to equip the VUZ's or departments with series-produced graph constructors. The corresponding softwear can be borrowed from organizations which already have working systems.

The creation of such a subsystem, at first elementary, will make it possible to organize laboratory classes at which that subsystem will be studied by students specializing in automatic designing systems, and to introduce as an obligatory demonstration work, single at first, for all students studying the courses "Machine building drawing" and "Engineering graphics." In the long-range future, by expanding that system it will be possible to use it in courses taught by departments whose profile is connected with the designing of given articles.

The latest automatic designing system subsystem which can be realized in a VUZ in packet conditions is the subsystem for the automation of calculations and optimization of designed articles and of scientific and technological forecasts. For those specializing in automatic designing systems the corresponding laboratory and practical courses should be devoted to the study of system programming and organization of the work of a subsystem. For students of all other specialties this subsystem is used as a means of automation of all calculations which must be made in doing course and certificate work, household tasks according to specialized programs developed and adjusted by qualified coworkers of the profiling departments.

What are the prospects of improvement of such laboratory practical courses?

The only path here is the obtaining and creation of hardware and software working on a shared time basis. On that level, the use of a so-called display station, produced by Soviet industry within the frameworks of the ES computers,

is promising. Also not excluded is the path of creating in the VUZ's time-sharing educational systems based on series-produced computers available at them and being acquired by them. Let us emphasize that in both cases it is extremely important to the VUZ's to obtain series-produced automated workplaces.

All the described approaches must be supplemented by the active use in the educational process of automatic designing systems working in scientific research institutes and design offices with which the VUZ maintains a creative connection.

An exceptionally important problem in the preparation of specialists in automatic designing systems is the timely creation and issuance of educational literature. Without belittling the importance of this question to specialists on hardware and software, and also on the development of branch software, we consider it especially important to prepare an educational manual on the principles of automatic designing systems. It is necessary for the effective training of all students having a relation to modern problems of designing.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

ACTIVITY OF THE INSTITUTE OF PHYSICAL CHEMISTRY

Kiev VISNYK AKADEMIYI NAUK UKRAYINS'KOYI RSR in Ukrainian No 3, Mar 77 pp 3-4

[Article]

[Text] The presidium of the Academy of Sciences [AS] Ukrainian SSR heard and discussed the report of the deputy academic secretary of the Department of Chemistry and Chemical Technology of the AS Ukrainian SSR, Corresponding Member of the AS Ukrainian SSR I. A. Shek, on the activity of the Institute of Physical Chemistry imeni L. V. Pisarzhevskiy of the AS Ukrainian SSR during the years 1973-1975 which was examined at the general meeting of the Department of Chemistry and Chemical Technology of the AS Ukrainian SSR.

The reporter pointed out that the institute occupies a leading place in the country with respect to the development of individual areas of catalysis and its use in industry and problems of bioinorganic chemistry and the physical chemistry of coordination compounds, the physical chemistry of free radicals, the chemistry of surfaces and radiation chemistry. Scientists of the institute obtained new and important results from the catalytic oxidation of hydrocarbons, created a number of effective catalysts for the purification of discharge gases of harmful impurities, obtained valuable information about the electronic and geometric structure of complex compounds of some transition elements, established quantitative regularities of the oxidation-reduction reactions of free radicals, created a theory of dissociation of molecules in an electric field and developed the physicochemical principles for obtaining new types of sorbents.

In the period covered by the report the institute completed a considerable volume of work on the introduction of scientific developments into the national economy. Together with the Kiev branch of the All-Union Scientific Research Institute of Complex Problems of Polygraphy, new types of decalcomanias have been introduced. A technology for obtaining radiation-modified netting was developed and used at the Brovarskiy Plastics Plant. Chemically modified aerosols created in the institute are widely used in the polygraphic industry and at enterprises of the "Iskozh" Association. Water-resistant plastic greases have been introduced at a number of enterprises of the motor-vehicle, textile and electrical equipment industry. In the course of the years 1973-1975 scientific developments of the institute gave a saving, confirmed by

documents, in the amount of 14.2 million rubles, of which 2.4 million were in foreign exchange. An important role in this belongs to the experimental production of the institute, the volume of production of which increased by 80% in the last 3 years.

The volume of state contract work of the institute reached 500,000 rubles in 1975, which amounts to nearly 32% of the total allocations.

During the period covered by the report the scientists of the Institute of Physical Chemistry defended nine doctoral and 55 candidate's dissertations. During the same time they published 13 monographs and 609 scientific articles, obtained 52 author's certificates and examined 26 applications.

Some shortcomings are noted in the activity of the institute. Scientific developments which took many years are not always completed by introduction into production or generalizations in monographs. At times the results of completed work are not included in the plans for experimental-industrial verification and introduction. Contemporary methods of automating scientific experiments and processing experimental data are not used sufficiently.

The head of the commission of the presidium of the AS Ukrainian SSR for reviewing the activity of the institute, Academician A. T. Pylypenko, Academician L. M. Lytvynenko, and chief technologist of the "Ukrplastik" Production Association G. I. Soroka, who spoke at the session, gave a positive evaluation of the activity of the Institute of Physical Chemistry.

The director of the institute, Academician of the AS Ukrainian SSR K. B. Yatsymyrskyy, reported on the establishment of close creative relations of the Institute of Physical Chemistry of the AS Ukrainian SSR with VUZ's, branch institutes and plants, and also on the formation of an experimental production branch of the Institute of Physical Chemistry at the Kalushskiy Chemical Combine and the participation of the institute in the organization of a scientific-instruction production complex.

Summing up the discussions, the president of the AS Ukrainian SSR, Academician B. Ye. Paton, emphasized that the Institute of Physical Chemistry, which has always been considered a theoretical institute, has in recent years made a large contribution to the development of practical work, without lowering the level of basic research. B. Ye. Paton noted as a positive fact also the use by the institute of the Kaluzhskiy Chemical Combine for the development of experimental production. He turned the attention of the directors of the institute to the fact that not all the scientific directions being developed in the institute are assured to a sufficient degree of personnel with high qualifications. More attention should be given to this question.

The presidium of the AS Ukrainian SSR adopted a resolution approving the decisions of the general meeting of the Department of Chemistry and Chemical Technology of the AS Ukrainian SSR entitled "On the activity of the Institute of Physical Chemistry of the AS Ukrainian SSR."

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

REINFORCING THE CONNECTIONS OF SCIENCE AND PRODUCTION

Kiev VISNYK AKADEMIYI NAUK UKRAYINS'KOYI RSR in Ukrainian No 3, Mar 77 pp 51-61

[Article by A. M. Kunayev, Corresponding Member of the AS Ukrainian SSR and president of the AS Kazakh RSR]

[Text] The political, economic and social life of our country remain under the unabated influence of the historic decisions of the 25th CPSU Congress and the October 1976 plenum of the CC CPSU and the speech of Comrade L. I. Brezhnev at that plenum.

In the speech of L. I. Brezhnev and materials of the plenum and the fifth session of the Supreme Soviet USSR of the ninth convocation are stated the tasks, principles and conclusions which contribute directly to the further development of science, the importance of which continuously grows.

However, a reliable role of science in the life of society cannot be assured by the efforts of the scientists alone. To do that, all links of the economic mechanism, of all participants in social production must be drawn in. It is necessary -- and this is constantly stated in the party documents -- to radically improve the style and methods of scientific and economic activity, to struggle more decisively against inertness and routinism, to treat science with respect, to be able and desire to take council with it and pay attention to it.

Science now also requires improvement of planning and economic stimulation in order to create conditions which would to a certain degree contribute to the very rapid passage of new ideas from inception to mass production, set a safe economic limit to the output of obsolete product and contribute to a decisive increase the effectiveness of research. Without it the economy is incapable of successfully advancing along the path of intensification and improvement of quality of work in all elements of the national economy.

Starting from the tasks of science formulated very definitely by the 25th CPSU Congress and in subsequent party documents, the AS Kazakh SSR, the 30th anniversary of the founding of which was celebrated last year, continues its activity.

More than 4000 scientific associates, 53 academicians and 79 corresponding members of the AS of Kazakstan, 190 doctors and over 1500 candidates of sciences are working in subdivisions of the academy. For services in the development of Soviet science, economics and culture and the training of highly qualified personnel the academy was presented a high award of the Motherland -- the Order of Friendship of Peoples.

Inspired by the decisions of the 25th Party Congress and the continuous concern of the Communist Party and Soviet government and of the general secretary of the CC CPSU, Comrade L. I. Brezhnev, personally about the further development of the republic, the scientists of our academy are working selflessly to implement the outlines of the congress and fulfil the tenth five-year plan, and are directing their searches toward further reinforcement of the material and technical base of communism.

Our Academy is executing very great national economic tasks rather successfully and has a substantial effect on the acceleration of basic research and the introduction of its results into practice. In the ninth five-year period alone, 675 themes were developed, 114 of them on tasks of the State Committee of the Council of Ministers USSR for Science and Engineering and 88 on those of the national economic plans of the republic. Three hundred and sixty projects were introduced into production and 432 underwent experimental-industrial testing; 650 author's certificates for inventions were obtained; 365 monographs were published. The national economic effect from the introduction of proposals of scientists of the republic amounts to over 200 million rubles.

The installations of the Department of Physical and Mathematical Sciences carried out a wide range of investigations in the area of computational and applied mathematics, mechanics, nuclear physics and astrophysics. In addition, valuable results were obtained in the area of the theory of ordinary differential equations and differential equations in partial derivatives; an algorithm was developed and mathematical models constructed for the process of aerohydroxyl drying.

Fundamental investigations of the creep and destruction of rocks were completed, the purpose of which was to calculate the strength and resistance of underground structures. On the basis of those investigations a mathematically rigorous theory of creep in the presence of small and large strains has been successfully constructed with consideration of the processes of lasting destruction. That theory is the scientific basis for the planning of reinforcement and disposition of underwater structures. The theory of creep of rocks is widely used for mining calculations in all the coal basins of the country. The saving from the introduction of recommendations developed on the basis of it in the Karagandinskiy basin alone exceeds 1 million rubles per year. The work won a State Prize of the Kazakh SSR.

Phenomena of superplasticity have been studied, and concepts created for the main regularities of their development; hypotheses have been advanced for the cause of the effect and the mechanism of its manifestation. Our developments in this area stimulated the wide study of those phenomena both in our country

and abroad. Systematic studies were made of the foci of deformations during the working of metals by pressure. An original model of the focus of deformations was created which makes it possible to approach in a new way the analysis of a number of phenomena of its technical processes, for example, such as rolling, immersion, stamping, etc.

The Section of Sciences of the Earth directed its efforts toward the solution of problems in the areas of geology, hydrogeology, geophysics, geochemistry, exploration of the depths of the earth, mining and geography.

One of the achievements of the department was the first compilation of a map of recent tectonics of the Kazakh SSR, with an explanatory text. The structures of three series formed during Neogenic-Quaternary time are depicted on the map, as are formations of the latest deposits and faults, renewed later, and the summary amplitudes of neodeformations and other neotectonic characteristics. The materials from neotectonics will be used for planning studies of the problem of transferring a portion of the runoff of Siberian rivers to the south, for searches for minerals and also for the seismic and geological engineering zoning of the territory of Kazakhstan.

Geological, geophysical and geochemical material on the Pricaspian trough and Northern Ustyurt have been generalized. Source formations of the sedimentary cover have been found, regional zones of hydrocarbon generation have been designated, and the time of formation of petroleum and gas deposits has been determined. Maps of prospects of the presence of petroleum and gas and a tectonic scheme have been compiled and recommendations given as to the direction of petroleum and gas prospecting.

Regularities of the action of diffracted waves of strains on the roof of chambers and change of the stressed state of the pillar also have been established, and the influence of seismic action of an industrial explosion on a supporting pillar has been investigated. Steel-polymer rods have been proposed for reinforcing the production space.

Scientists of the Department of Chemical Engineering Sciences have made a large contribution to the development of the chemical and petroleum industries and to ferrous and nonferrous metallurgy.

In close collaboration with scientists of the country and especially of the All-Union Institute of Nonferrous Metals (at Ust'-Kamenogorsk) the latest highly intensive oxygen dependent cyclone electrothermal metallurgical process has been developed. In contrast with traditional methods of smelting copper (reverberatory and shaft), this process makes it possible to use in nonferrous metallurgy cyclone smelting units in a combination with an electrically heated settler with a separate melt outlet, using in that case such an intensifier of metallurgical processes as oxygen and electric power. The potential economic effect from realization of the oxygen technology at some enterprises of nonferrous metallurgy is almost 45 million rubles per year. In addition, by means of this technology the solid and gaseous wastes of production are almost completely utilized, and this contributes to preservation of the environment. Testifying also to the exceptional novelty of the process is the fact that it has been patented in 16 countries.

A new method of smelting copper concentrates in a liquid bath, developed by scientists of Kazakhstan jointly with the Moscow Institute of Steel and Alloys in the ninth five-year period, was introduced in 1976 at the Balkhashskiy Mining and Metallurgical Combine. Thanks to the method the unit productivity of existing reverberatory furnaces is increased 20 times and that of furnaces for levitation melting by 10 times. The process of smelting in a liquid bath is capable of completely eliminating expenditures of fuel containing carbon in the production of copper by assuring effective utilization of gases and slags.

Fundamental investigations have been conducted in the theory and practice of liquid-phase catalytic hydrogenization. Work has been done on the creation of new and the improvement of known catalysts of the complete combustion of the exhaust gases of internal combustion engines and the discharge gases of chemical production facilities. New catalysts have been developed on metal carriers which have shown good results in carbon monoxide oxidation, and new highly effective catalysts of the reduction of nitrogen oxides.

On the basis of physicochemical investigations methods have been found for controlling the process of formation of concentrated phosphates in a fusion and in the solid state. This makes possible the purposeful synthesis of new concentrated complex fertilizers and fodders, besides polyphosphates, on the basis of various types of phosphorite raw material of Karatau.

In metallurgy the main attention was given to the development of new and the improvement of existing metallurgical processes with the complex use of raw material. A new technology was developed for the processing of intermediate products of metallurgical production with the use of complex formation, which reduces the time required for the process and helps to make the selection of metals as complete as possible. That work has been awarded a State Prize of the Kazakh SSR.

Ways are sought to obtain complex alloys and use them in steel smelting production. The complex processing of Lisakovskiy ores has been studied. The principles of a theory and technology of blast-furnace smelting with the blasting of fluxes into the furnace has been developed. Optimal compositions of intermediate and final blast-furnace slags and the composition and conditions of transportation of flux-mazout mixtures have been recommended, and installations for feeding fluxes into the blast-furnace have been proposed and introduced.

Institutes of the Department of Biological Sciences are working on problems in the further development of biological science and the opening up and rational use of the natural resources of Kazakhstan. Thus, there have been many investigations of the lower reaches of the Ural, Syrdar'ya, Talas, Assa, Chu and Ili rivers. Regularities in the formation of salt conditions of irrigated soils have been found and recommendations have been developed and transmitted to water management organizations regarding the regulation of water use and methods of avoiding secondary salination of irrigated soils.

A summary reduced ground map of Kazakhstan has been compiled on a scale of 1:250,000. The map was exhibited at the All-Union Exhibition of Achievements of the National Economy of the USSR and won an honorary certificate, and its authors were awarded medals. A study of the conditions of ground processes at two stations in the Gobi Desert has been completed; the Soviet-Mongolian expedition was entrusted with the compilation of a ground map of the desert part of the Mongolian People's Republic.

Regularities of the form-creating process during the distant hybridization of wheat were studied. Promising interspecies hybrids of wheat AN-10 and AN-11 were bred and transmitted to the state variety testing. Technological and biochemical investigations of hybrid material and the collections of the All-Union Scientific Research Institute of Plant Growing (VIR) made it possible to discover combinations of parental pairs with a large yield of high-protein hybrids and forms of wheat with good technological and bread-baking properties; such combinations are important for selection in the south of Kazakhstan.

The structure and dynamics of the productivity of the pastures and hayfields of the desert zone of Kazakhstan have been studied. An evaluation was made of the types of sandy pastures on the basis of their productivity and seasonal nature of use. Recommendations were made regarding the rational operation and preservation of the vegetation of Northern Priural'ye, Northern Pribalkhash'ye and the hayfields of the lower reaches of the Chu River, and also the conditions of releases of water from the Kapchagayskoye reservoir to create optimal conditions for maintenance of the hayfields of the Ili River delta in a productive state.

The institutes of the Department of Social Sciencies in the last five-year period studied problems of the long-range development of the national economy of the Kazakh SSR, history and literature, ethnography, archeology and linguistics, philosophy and the law. Qualitative shifts in the economy of the republic have been shown, and regularities of its socio-economic development in the contemporary stage and tendencies of growth of the contribution of the republic to the creation of the material and technological base of communism have been determined.

On questions of the history of dialectics and the methodology of science such monographs have been published as "Dialektiko-logichni pryntsypy pobudovy teoriyi" [Dialectical and Logical Principles of Theory Construction], "Dialektyka empirychnogo i teoretychnogo v istorychnomu piznanni" [Dialectics of the Empirical and Theoretical in Historical Cognition] and "Dialektyka ob'yektyvnogo i sub'yektivnogo u konteksti vidkryttya" [Dialectics of the Objective and Subjective in the Context of Discovery].

Much importance was attributed to study of the scientific legacy of the eminent encyclopedist and philosopher Abu-Nasr al Farabi. His works "Filosofs'ki traktaty" [Philosophical Treatises], "Sotsial'no-etychni traktaty" [Socio-ethical Treatises], "Matematychni traktaty" [Mathematical Treatises] and "Pro rozum i nauku" [On Reason and Science] and also the monograph "Matematychna spadshchyna al'-Farabi" [The Mathematical Legacy of al Farabi] were published.

As you know, the sphere of scientific problems and questions in the field of vision of our academy is fairly wide and urgent. It must be emphasized that we attribute great importance to the introduction of our proposals in the national economy. The purpose of most of the introduced proposals and of those which are in the state of introduction is to contribute to the technical progress of nonferrous and ferrous metallurgy and the coal and chemical industries and to increase the output of agricultural production.

Let us mention some of the very important work used in practice. A new technology of ore excavation using self-propelled equipment, introduced at the Dzheskazganskiy Mining and Metallurgical Combine, brought about (in 1971-1975) an increase in the total ore production of 58 to 64.4%; the saving is 2.1 million rubles. At the Mirgalimsayskiy mine of the "Achpolimetal" Combine the worked area is filled with concentrator tailings. Over 1.5 million cubic meters of empty space are covered there; the ruination of structures with a total value of more than 3.2 million rubles has been avoided, and the mine is not threatened by flooding with freshet and mine waters. Organization of the new method of filling permitted obtaining 587,100 tons of rich ore from the protected land and reducing expenditures on the output of concentrate by 2.4 million rubles.

The electrothermal method of processing intermediates (dust and dross) with the use of complexing agents, introduced at the Leninogorsk Lead Plant, has assured direct extraction from dust: over 95% of lead into metal, 95-96% of cadmium into rich cadmium sublimate, and 83-89% of zinc and sodium into sodium matte-slag fusion. The saving is 1.7 million rubles. The work has been awarded a State Prize of the Kazakh SSR.

Here are a few more such examples. A new technology and apparatus for the continuous vacuum refining of lead has been introduced at the Novosibirskiy Lead Combine. As a result the extraction of lead was increased, the output of lead of low grades was halted, the technological process was automated and working conditions were improved. The saving is 1.1 million rubles per year. At the Karagandinskiy Metallurgical Combine a technology for the production of tar-bonded dolomite refractories from local raw materials is used. This also is an achievement of the AS Kazakh SSR.

Their use assures resistance of the linings of 250-ton converters for 300-400 smeltings and the obtaining of a saving of 2.7 million rubles a year. The introduction of a technology for the purification of acetylene by hypochlorite solution has been completed at the Karagandinskiy Synthetic Rubber Plant. As a result of reduction of the chlorine concentration in the purified acetylene by three times expenditures of mercury in acetaldehyde production has been considerably reduced and a saving of 2.5 million rubles obtained.

All the above-mentioned are some of the important aspects of the activity of the academy of sciences. A no less important part is inventive and patent-licensing activity and the obtaining of author's certificates. Here too we have made some advances. In the period 1971-1975, 1487 applications were submitted for inventions and 648 decisions to issue author's certificates were obtained. Twenty-three objects, including 44 inventions, were patented abroad.

Author's certificates have been obtained in Bulgaria and patents in the United States, Japan, England, France, the GDR, Canada, Italy, Belgium, India, Czechoslovakia and Romania.

As is known, the present five-year period is one of efficiency and quality. The scientists of the republic are directing their efforts toward increasing the effectiveness and quality of investigations conducted by them and the very rapid and complete organization of the rich natural resources of Kazakhstan, their rational use and renewal, all possible expansion of the volumes and increase of the efficiency of production and comprehensive development of the productive forces of the republic.

For that purpose the following investigations and endeavors have been envisaged:

In the area of mathematics and mechanics work is being done on the solution of point boundary-value problems, processes of heat and mass exchange and the theory of approximation. We expect to obtain a description of free algebras of investigated varieties and to complete work on the synthesis and analysis of structures.

Needed for the intensive mastering of the depths of the earth is study of the mechanics of rocks and geological processes. In this area it is proposed to develop methods of solving static and quasistatic problems with consideration of heterogeneity, roughness, foldedness and fissuring of the rock masses, and also of the theory of slow tectonic processes in the earth's crust.

Much attention will be given to interactions of hadrons with nuclei and of pions and nucleons of cosmic rays with nucleons and nuclei at energies not accessible on accelerators.

Considerable efforts will be directed toward investigations of regularities in the structure and evolution of the earth's crust of Kazakhstan, the disposition of metal, non-ore and combustible minerals, and also the seismicity of the territory of the republic.

For the further development of the underground extraction of ores by increasing the use of mineral raw materials, improvement of the safety of working conditions and assuring a sharp increase of the rates of production, methods of mineral extraction new in principle are being created and introduced, and the existing technology is being improved on the basis of complex mechanization of production processes. Work is planned to study the nature of rock pressure and determine its regularities during the underground working of the riches of Dzhezkazgan, Mirgalimsay, etc. It is proposed to develop the scientific principles and ways and means of improving sanitary and hygienic conditions of work and reduce occupational diseases at mines and quarriers.

Of scientific and practical importance are investigations of the problem of complex use of ores of nonferrous, rare and light metals. For that purpose it is planned to search for and introduce processes for the smelting of copper and copper mixture polymetallic concentrates in the molten state with complex use of raw materials.

In the area of the production of lead and metals accompanying lead production new methods based on high and superhigh rates of oxidation-reduction processes with the use of natural gas and electric power will be proposed and introduced. It is proposed to develop new processes and technological schemes based on methods of the metallurgy of thio salts.

With respect to the complex processing of aluminum raw material and increasing aluminum production, it is planned to conduct investigations to improve the existing technology and bring the new riches of Kazakhstan into industrial production.

It is known what importance the production of gallium and its alloys has, the complex production of titanium-containing raw material, and or rare and light metals, and also the concentration of minerals; in connection with that studies are conducted of the possibility of using physical methods of smelting -- ultrasonics and magnetic and electric fields.

Included in the cycle of investigations in chemistry and the chemical industry are the analysis of reactions and processes of the synthesis of new types of monomers and polymeric materials with a complex of predetermined properties, the obtaining of natural and synthetic biologically active compounds and the creation of physicochemical principles for obtaining fertilizers, salts, metals and inorganic materials by the complex processing of mineral raw material and discharges of the chemical and metallurgical industries.

One of the important problems in studying the solar system in the coming decade is investigation of the physical properties of the giant planets. Used for that purpose are both ground means and, in the near future, means of space technology. The Astrophysical Institute of the AS Kazakh SSR by decision of the presidium of the Astronomical Council of the AS USSR is the coordinating institution responsible for the development of research on this problem in the country. Studies of the structure and dynamics of the galaxy and of the physics of solar activity also are planned.

Institutes with a biological profile continue to develop earlier work on problems of soil formation, the formation of the soil cover, the improvement and preservation of soils, study of parasites of animals and plants and the biological principles of regulation of the numbers of invertebrates and the directions of their change. Work is being developed on investigation of the physiology of visceral systems and the mechanisms of regulation of their activity. Work will be continued which uses the genetic principles of selection and the individual development of agricultural animals and the formation within the limits of this problem of a a new breed of cross-bred sheep, plant types of Arkhara merinos and highly productive protein-milk lines of dairy cattle.

The microbiologists are directing their efforts toward the creation of the physiological and biochemical principles of the utilization of microorganisms and viruses in the national economy and the preservation of health. Investigations are conducted in the direction of the development and introduction into practice of a new technology of microbiological production and the creation of physiologically active substances.

Botanists are participating in solving the problem of age and optimization of physiological processes in connection with the productivity of plants; methods of studying the regularities of biosynthesis and discovering methods of increasing the resources of plant raw material are designated. A considerable volume of investigations is devoted to the formation of the plant world of Kazakhstan, the study of its present state, rational use and predictions of changes connected with scientific and technological progress.

Zoologists are planning investigations of the regularities in the formation of biocenoses under the conditions of intensive development of the national economy of the republic. Sketches are provided of efforts at the purposeful formation of biocenoses of useful grasses which were present before the cultivated landscape, and searches are conducted for ways to enrich the fauna with useful grasses by the method of acclimatization and the preservation of thin and falling grasses at plantations and preserves.

In the area of the social sciences a number of large investigations were conducted, especially on such problems as regularities of the development of Kazakh literature and its connections with other literatures, the history and contemporary state of Kazakh art, materialistic dialectics and logic, the theory of cognition and methodology of science, regularities of the internationalization of social life and problems of the formation of the personality in the period of the building of communism, legal regulation of the national economy and the use and preservation of natural resources.

The development and theoretical substantiation of the principles, forms and methods of organization of production are planned with consideration of their optimization. Regional, economic and social problems of the long-range development of the national economy to the year 1990 are being studied.

Thus extremely important scientific and practical tasks are inscribed on the agenda of activity of the academy.

The effectiveness of those tasks is determined to a considerable degree by the substantiation of the forms and methods of arranging business relations with production. Already in 1976 more than 33% of the projects worked out by institutes of the academy have been introduced at 152 enterprises, kolkhozes and sovkhozes of the republic. Over 40% of them are carried out on a state contract basis, for which 140 contracts for a sum of more than 4 million rubles have been concluded with plants, kolkhozes and sovkhozes.

In the past year more than 75 projects of co-workers of the academy underwent state-industrial testing at 100 enterprises, kolkhozes and sovkhozes and in variety testing sections, and 36 projects are being introduced at 50 objects -- the Dzhezkazganskiy Mining and Metallurgical Combine, the "Achpolimetal" Combine, the Vostochno-Kazakhstanskiy Copper Chemical Combine, the Pavlodarskiy Aluminum Plant, the Irtyshskiy Polymetals Combine, the Ust'-Kamenogroskiy Lead and Zinc Combine, etc.

The conclusion of state contracts changes the relations of science with production. It shortens the time required for the introduction of the achievements of research and thus has positive aspects, on the one hand. On the other, it has negative, if they are concluded for small work of purely informative value, embrace minor links of the technological process and do not have an important influence on the technical re-equipment of the enterprise.

This happens because not all enterprises can independently solve questions in the concluding of contracts for a large sum and a long term. Some agreements confuse the thematic plans of institutes, give rise to unimportant themes and hinder the concentration of scientific forces on the working out of important fundamental problems. As a result, instead of contributing to the development of scientific and technological progress at the enterprises, the attention of scientists is distracted to extending minor technical aid. In the meantime, it is evident that fundamental developments provide very important and original practical proposals.

Given themes are usually developed in the laboratories of institutes or together with production people in shops, teams and on farms. According to the results of investigations, enlarged laboratory tests are conducted at the enterprises. To obtain positive data the experimental verification is conducted, as a rule, under production conditions. The next step is experimental industrial verification. And only after that, if resources and approval of the corresponding ministries and the Gosplan have been obtained, does introduction start, and at enterprises where the experimental-industrial testing occurred.

In the structure of an entire series of large enterprises of the republic there are experimental shops where the object being introduced in the course of experimental-industrial testing undergoes technical modifications, and only after that is used to equip production.

The AS Kazakh SSR has research installations in experimental shops at 15 enterprises of the country, and this makes it possible to considerably reduce the time required for verifying the results of investigations, increase the quality and reliability of the introduced object and change the relations of science with specific branches of the national economy.

The best of the new developments of the scientists of our academy are proposed for wide introduction, with proposals sent to the AS USSR and the State Committee for Science and Engineering; as a rule they have already been introduced at one of the enterprises of the republic and substantiated technologically and economically. There are from 25-30 to 50-80 such proposals each year.

The AS Kazakh SSR discusses the results of completed investigations with the Gosplan of the republic and individual interested ministries, and on the basis of that specific proposals are introduced in the directive agencies. Creative contacts have now been established with the ministries of chemical industry and nonferrous and ferrous metallurgy and all obkoms of the party and oblast executive committees of the republic. At conferences convoked by them there also are discussions of use of the achievements of science in production and specific

decisions are adopted, directed toward the elimination of shortcomings and acceleration of completed research which has to be introduced into practice.

Very often the scientist who develops a new technology or technological process cannot overcome the barrier of engineering and design solution of the problem and therefore his idea must be rejected; by the same token the creation of special design offices would help in the timely implementation of a given idea.

To overcome such a barrier and accelerate the emergence of scientific developments into practice, introduction groups or sections have been formed in many academic institutes with a technologial profile. There also is such a group under the Presidium of the AS Kazakh SSR. It studies the national economic importance of the rsults of completed theoretical investigations, examines the research and research-industrial testing of developments and coordinates with the ministries and departments the volume of research-industrial tests, plans and periods required for introduction, financing and designation of enterprises where such testing is done. The same group calculates the economic effect of introduced developments.

The creation of an introduction group under the presidium of the academy and of corresponding groups or sections in the academic institutes considerably improved the relations of science with production and increased the responsibility of scientists for the formulation of documentation for completed work, which, naturally, is of very great importance.

Under today's conditions the academy plays a large role as the organizer of scientific research activity in the republic on the most important problems of the natural and social sciences. Its scientific councils designate the main directions and tasks of basic and exploratory research, do long-range planning, prepare coordination plans of research work and designate the group of institutes and VUZ's which will participate in the solution of problems.

In the academy research is coordinated by 29 scientific councils, three commissions and four scientific councils which include almost 500 eminent scientists of the academy and of VUZ's and representatives of various ministries and departments of the republic. A great many councils have become scientific centers of the republic with respect to corresponding problems, and such councils as "The Natural Focus of Diseases" and "Catalysis" are sections of the AS USSR and the State Committee of the Council of Ministers USSR for Science and Engineering and coordinate research on the scale of the country. The council for the Problem "Plant Physiology and Biochemistry" is regional and coordinates investigations in Kazakhstan and Kirgiziya.

The councils for the Problems "Dialectics of Development of National Relations" and "Regularities of the Development of Kazakh Literature in the Soviet Epoch" coordinated in the past five-year period research with such themes as: "The solution of the national question in the republics of Central Asia and Kazakhstan" and "The contemporary literary process and interactions of the literatures of the nations of Central Asia and Kazakhstan" (collective monographs). Institutes of the academies of sciences of the republics of Central Asia and Kazakhstan, and also VUZ's of our republic, participated in their preparation.

Included in the consolidated coordination plan of the academy for 1976 were 490 themes, 269 of which are being carried out by institutes of the academy, and the rest by VUZ's of the Ministry of Higher and Secondary Specialized Education, the Ministry of Education Kazakh SSR and noted research institutes of the republic.

The creation of scientific councils has had a positive influence on the activity of the academy. The level of the work has risen, problem tasks on the development of basic research are organized more widely, and questions of importance to the national economy are being solved; the councils are convoking conferences, consultations and excursion sessions at which permanent seminars on problems are formed.

Planning is one of the key problems in the administration of science. How can it be further improved? First, by proper combining of centralized state planning with the broad creative initiative of scientific organizations; secondly, elevation of the role of economic methods in planning on the basis of consideration of certain technical and economic advantages and novelties of research and development before their introduction into thematic plans; thirdly, assuring complexity of research and shortening possible gaps on the borders between fundamental, applied and design-technological developments, and also between them and the stage of industrial introduction of their results; fourthly, optimal correspondence of state-budget and state-contract themes.

With accelerated rates of scientific and technological progress a need arises to foresee their consequences. Therefore today as never before the task of wide use of methods of forecasting the development of science and technology has been set sharply. Long-range planning must, firstly, include problems which designate the main directions of scientific and technological progress and give a considerable saving. Needed are not only great organizational and coordinational efforts in all stages of developments but also exceptional practical experience.

The planning of work in the natural and social sciences remains multistage. The planning procedure now in effect, when the executors independently designate and agree upon the research program, must be improved.

In our opinion the gosplans of the union republics and the Gosplan USSR should be obliged to designate the group of enterprises where scientific developments could be introduced, to charge the Gosplan with the functions of bringing the proposals of institutes into agreement, which will make it possible not only to consider those proposals and on a state scale organize the relations of science and production, allocate a great deal of time for research and reduce expenditures on equipment.

Included in the plan of development of the national economy are all the themes of the institutes, coordinated by the State Committee of the Council of Ministers USSR for Science and Engineering. Let us note that not all those coordination plans are sufficiently substantiated with those who are to carry them out. In some of them neither the editing of the themes nor the volume of the planned work, nor the provision of materials and financing have been organized.

Included here at times are themes at the request of executors without the knowledge of the board of the institute or the presidium of the academy, not provided with personnel or financing.

Shortcomings in the planning of scientific research work have the result that the state loses rather valuable proposals on the development of scientific and technological progress in individual branches of the national economy. On account of that a need has arisen for the State Committee for Science and Engineering and the Gosplan USSR to formulate in a more differentiated manner the themes of coordination plans and plans for the development of the national economy.

Desiring to better organize the conducting of investigations and achieve improvement of their effectiveness, the presidium of the AS Kazakh SSR has attentively and thoroughly studied the leading forms and methods of organizing the relations of science with production developed by scientists of the AS Ukrainian SSR and decreed by the CC CPSU.

Work has already been started on the organization of interbranch laboratories created on the basis of academic and other institutes and enterprises. The laboratories coordinate research work and solve scientific and technological problems connected with the introduction of highly effective scientific proposals into practice.

On the basis of one of the institutes of the Department of Chemical Engineering Sciences it is planned to create a design office on a state reimbursement basis to service institutes of the academy.

A decision was adopted to increase the responsiblity of the Council for Study of Productive Forces under the presidium of the AS of the republic and to activate it in questions of the coordination and introduction of the results of complex developments of great national economic importance.

In that connection all the scientific institutions and VUZ's doing scientific research work on the territory of Kazakhstan, regardless of the department to which they belong, are obliged to submit for the consideration of that council a thematic plan of their investigations and to participate in the development and solution of problems in the mastering of natural resources and the rational disposition of the productive forces of the republic.

To further develop and reinforce the relations of science with production the possibilities of the academy to conclude large state contracts with ministries, departments and enterprises for a period of five years or more are reviewed. Such contracts provide for the unification of basic and applied research which would obtain a yield most quickly in practice.

The presidium of the AS Kazakh SSR instructed its departments and the Council for Study of Productive Forces to prepare specific measures directed toward finding forms and methods of elevating the technical level of production and increasing labor productivity on the basis of the introduction of new

technology and equipment, and also to designate the direction of business contacts with oblast party and soviet agencies on the use of the results of investigations at enterprises located on the territories of the respective oblasts.

Side by side with the positive aspects in our activity there are, unfortunately, shortcomings; not all scientific institutes have as yet developed and thoroughly substantiated ways to increase the effectiveness of investigations and the introduction of their results into production; individual institutes are ridding themselves of smallness of theme and the scattering of scientific forces and material and financial resources caused by that more slowly than could be desired; the coordination of forces of scientific institutes and production enterprises in the accelerated solution of the most important problems of science and the national economy has not been perfected; the directors of scientific themes, problems, laboratories and institutes who select and place personnel still indecisively thrust forward talented youthful scientists, at times do not support the principle of wise combination of the efforts of veterans of science and young scientists and succession in the work, etc. These and other shortcomings remain at the center of attention of the presidium of the academy, which has designated ways to overcome them and not allow them in the future.

We expect that the activation of scientists of our academy, which was especially intensified after the 25th CPSU Congress, the course decisively taken by them to fortify and further expand the relations of science with production and practice, will exert a positive influence on the growth of the scientific potential, acceleration of scientific and technological progress and the successful execution and overfulfilment of the plans of the tenth five-year period.

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SCIENTIFIC RESEARCH IN ACADEMY OF SCIENCES LITHUANIAN SSR

Kiev VISNYK AKADEMIYI NAUK UKRAYINS'KOYI RSR in Ukrainian No 3, Mar 77 pp 62-70

[Article by Yu. Yu. Matulis, Corresponding Member of the AS USSR and president of the AS Lithuanian SSR]

[Text] The effectiveness of investigations connected with the development of the productive forces of the USSR is a constant concern of all scientific institutes of the country, including institutes of the AS Lithuanian SSR. In our republic that problem became especially urgent and complex after the reorganization of scientific institutions which took place at the start of the 1960's -- the transfer of all academic institutes and other institutions with a practical profile to the appropriate ministries and departments.

When installations only with profiles in the natural sciences and the humanities remained in the Lithuanian Academy of Sciences, it lost research personnel and the material base for applied investigations and developments. Therefore the consolidation of institutes and other subdivisions which remained in its composition and the concentration of all forces on basic research in a limited number of the most urgent directions became an urgent task of the management of the academy. A relatively small academy could not pretend to study a wide range of questions, especially those for which costly and special-purpose equipment is required. In other words, an urgent problem of clear profiling of the institutes arose.

In selecting the directions which were to become the basis for the formation of the profile or scientific visage of our academy, first of all the presence at that time of trained highly qualified personnel both in the system of the academy and in the republic as a whole was taken into account, as well as the accumulated scientific reserves, such as existing highly productive groups or embryos of original scientific schools which had already manifested themselves, and the main thing, the demands of the national economy of the republic. With consideration of all the mentioned aspects nearly ten principal scientific directions were designated, which at the beginning of 1964 were approved by

the presidium of the AS USSR. They also became the main and long-term program of scientific and organizational activity of the academic institutes.

Ordinarily, far from all of those directions were equivalent in breadth of content and problematics and required identical efforts for their development. For example, developing investigations in the theory of probabilities and mathematical statistics, mathematical problems of cybernetics and technical cybernetics, the theoretical spectroscopy of atoms and molecules, the physics and chemistry of semiconductors, high-temperature thermophysics, the theory of the electrodeposition of metals and the development of methods of galvanic coatings with prescribed properties, we have already in 3-5 years clearly profiled the institutes of physics and mathematics, the physics of semiconductors, physicotechnical problems of power engineering, chemistry and chemical engineering. Scattering of themes was eliminated in them and the main efforts were directed toward the complex solution of principal problems. Thanks to that, real successes were achieved quickly. The results of the work of those institutions received wide acclaim already in the eighth five-year period but in our country and abroad and began to be introduced into practice far beyond the borders of the republic.

Many difficulties were found in studying scientific directions with a broad profile and less distinctly formulated, for example, the biological principles of increasing the productivity of plants and animals. Although in this direction institutes with a biological profile (biochemistry, botany, zoology and parasitology) were organized to solve questions important to agriculture, it contributed little to their narrow profiling and the concentration of efforts on the complex solution of a small number of urgent problems. As a result of this, in institutes with a biological profile there still is a large number of themes and clear coordination of work has not been organized both between institutes and between their individual sectors and laboratories. These gaps are being intensively removed in the present five-year period.

Before the reorganization of the academic institutions institutes of the humanities also were profiled in the main directions.

Regardless of many difficulties and a certain inertia of individual scientists, the narrow profiling of most institutes was completed approximately in the middle of the eighth five-year period. This was reflected positively in the themes and especially in the level of research. Thus the results of work during the eighth five-year period alone, as regards both the number of publications and the scientific level, considerably surpassed the totality of the corresponding results during the same past period.

It is generally known that, although some urgent problems will be solved, this is only the first stage in the realization of scientific ideas in practice. The data of basic research, as a rule, still have to travel a long path leading to their use in production. Experience shows that research of an applied type directed toward the completion of fundamental work can be done rapidly and in a qualified manner by the same institutes where the basic research is done. Therefore another stage in the realization of scientific

ideas must be research and developments of an applied nature. They are becoming another area of working plans of institutes of the academy which combine scientific and technological themes with direct application in practice. Large state contract work is added later to the plans with scientific and technological themes.

Thanks to the constant efforts of both the presidium and the management and party organizations of institutes the scientific and technological themes have gradually been expanded. Thus, whereas in the course of the years 1966-1970 their percentage reached only about 10% of the total work plan of the AS Lithuanian SSR, in the tenth five-year period that area of the themes increased to 23.5%.

Increase of the percentage of scientific and technological work not only created real conditions for the purposeful selection of very urgent problems and contributed a great deal to rapidly bring the data of fundamental investigations to their practical use, that is, increased the effectiveness of all scientific work. For example, whereas in the course of the eighth five-year period only about 50% of 664 completed large themes found practical application, in the present five-year period about 70% of 1014 completed themes are finding practical application. Of course, not all of them are equivalent, but it can be pointed out that the total saving from developments of the AS Lithuanian SSR introduced into production in the period 1971-1975 is considerably larger than the sum allocated in the state budget to support the entire academy.

The economic effectiveness of the academy in the ninth five-year period could be greater if the time between the completion of theoretical work and the obtained data are put to use in practice were shortened. It is thought that in the future, especially in the energetic implementation of the decisions of the 25th CPSU Congress, scientific and technological research and research developments must be conducted almost simultaneously and effectively coordinated. However, this has been hindered up to now by the absence in the system of the academy of consolidated experimental bases for research and design work and the organization of new technologies. We began to fill that gap at the end of the ninth five-year period and hope to complete that matter in the main by the end of the tenth five-year period.

As early as 1972 the AS Lithuanian SSR was given the responsible and complex orders: together with the ministries and departments to prepare forecasts of the long-range development of complex scientific, technological and socio-economic problems having a direct influence on the long-range plan for the development of the productive forces, national economy and culture of the republic. In the beginning we proceeded to accomplish another part of that complex task -- to develop a scientifically substantiated concept of the development of the main directions of the national economy of the Lithuanian SSR for the period 1976-1990 and clarify the most important problems connected with them. For this purpose, 19 working groups were formed in the AS Lithuanian SSR with a single directing and coordinating center headed by the vice president of the academy, Academician A. A. Zhukauskas of the AS Lithuanian SSR.

The coordination center and working groups include over 150 eminent scientists and engineers from production organizations of the republic. All the groups and their personnel were approved in mid-1972 by the appropriate agencies and started work.

All institutes of the academy and large VUZ's of the republic, and also all ministries and departments, participated actively in the activity of the created collective of scientists and production workers. As a result of collective efforts, at the beginning of 1973 the first variant of a 20-volume work was completed which contains a substantiated general concept of development to 1990 and forecasts of the rates and proportions of the national economy of the republic, the numbers of population and the balances of labor resources of the Lithuanian SSR, the development of such branches of production as power engineering, the fuel balance, the refining of crude petroleum, the chemical and microbiological industries, the manufacture of plastic articles, machine-tool and machine building, the forest and lumber industry, the meat, milk and food industry, the fishing industry, light industry, the production of building materials, agricultural production, developments of transport and communications, commerce and household services. Long-range forecasts also were prepared of the use of mineral and water resources of the republic, and also forecasts of the most probable changes of the natural environment up to the year 2000.

The prepared draft of the general concept of the development of the productive forces of the republic was discussed in detail at conferences organized by the academy with the participation of party and Soviet managers and also the broad scientific and economic community. Substantial corrections and supplements were introduced in the course of the discussion. On the basis of the final variant of the general conception and of scientifically substantiated forecasts of the development of the productive forces of the republic, forecasts of the development of science to the year 1990 were prepared, that is, the most promising scientific and scientific-technological problems, to be studied first, and also research and design developments, were designated. Together with that, forecasts of the training of scientific personnel and the development of the material base of science in the republic were designated. Possible prospects with respect to health protection, social insurance, popular education, various areas of culture, etc, were not set aside.

The general concept and forecasts of the development of the productive forces of the republic are now used by planning agencies in the preparation of five-year and annual plans for the development of the national economy. In 1975 they were made the basis of a draft of research plans both of the academy and of most VUZ's of the republic for the tenth five-year period. Those drafts and the entire coordination plan of research for 1976-1980 for sections of the republic were finally refined at a session of the AS Lithuanian SSR devoted to the main tasks set before science by the 25th CPSU Congress.

Without going into detail, it should be pointed out that both the working plan of the academy for the tenth five-year period and the coordination plan of scientific institutions and VUZ's of the republic prepared under the leadership

of the academy differed considerably from the similar plans of previous five-year periods. The difference consists primarily in the fact that in the present plans the problems are much more purposeful and better connected with problems of the national economy and a number of branches of production of the country. Better connection of scientific activity with the practical needs of communist construction was achieved not only as a result of much preparatory work which preceded the compilation of the five-year plans of investigations for the period 1976-1980, but also because in the course of the ninth five-year period the academy considerably reinforced itself and its personnel increased by about 32%.

As a result of great increase of the scientific potential of the AS Lithuanian SSR, in many institutes new laboratories and other subdivisions were created, in particular a large department of philosophy, sociology and the law which is now being reorganized into an independent institute. During the tenth five-year period, together with already existing directions which are being productively developed, a number of new ones have been formed and reinforced. The most productive of them are: mathematical problems of cybernetics, technical cybernetics and computer software, study of the Galaxy by methods of polychromatic photometry, study of physicochemical processes of contamination and mechanisms of purification of the atmosphere, biochemical and genetic principles of the formation of the natural environment of the Lithuanian SSR, interactions of a developed socialist society and the individual under the conditions of the contemporary scientific and technological revolution, etc. The foreseen development of work in those directions made it possible to grasp in a new way urgent problems of practice in the plans of scientific work of the tenth five-year period.

In compiling the plan of research work for 1976-1980, its broad discussion at problem councils and especially during refinement in the light of the decisions of the 25th CPSU Congress, much importance was attributed to intensification of scientific activity, that is, increase of the labor productivity of scientists. The practice of past years has shown that when there is competent management and reliable coordination new and very valuable scientific results are accumulated more rapidly and their introduction into practice is accomplished in a shorter time if large themes or tasks are developed more complexly and large collectives are gathered around them. Therefore we desired that in the plan of the academy for the tenth five-year period most of the problems would be divided into a small number of important themes or tasks with a predominance of their complex development. As a result a collective consisting of 15 persons on the average works on each theme. In the ninth five-year period 5.5 workers on the average were united around a single task, including state-contract themes (plus auxiliary personnel).

A very important way to increase the intensity of research is the mechanization and automation of scientific work. In research institutions is an extremely complex and multifaceted process directly connected with the development of scientific instrument-making. This applies not only to the automation of experiments and the processing of quantitative results of investigations but also the gathering of a variety of information, library work, the reproduction of specialized literature, training material, etc. It is necessary

to always provide laboratories with the latest automatic and registering apparatus and instruments, replace obsolescent equipment with modern and supply the institutes with computers and copying equipment. Therefore, as is known, this not only requires large expenditures of materials but also is made difficult by a shortage of some instruments of Soviet origin. For peripheral institutions the problem of acquiring special-design imported instruments is still more complex. Therefore in the plan of the present five-year period it is proposed to intensify in the academy work on the study, design and manufacture of prototypes of new scientific and standard instruments and apparatus. For that purpose, the complex problem "Creation of instruments and apparatus" has been introduced into the plan, and its development has been entrusted to the Institute of Physics of Semiconductors and other institutions of the AS Lithuanian SSR.

No less complex problems arise also in planning the supplying of institutes of relatively small and average size (of which there are many in our academy) with computer equipment. Here it is necessary to achieve not only savings of material costs but also the most advantageous use of computer machine time. Up to now only three academic institutes (of Physics and Mathematics, Physicotechnical Problems of Power Engineering and Economics) have been equipped with electronic computers. Although the use of methods of computer technology in scientific work is being further expanded, it still is not planned to equip the institutes with computers. Instead it has been decided to create in the system of the academy two time-sharing computer centers -- at the Institute of Physics and Mathematics in Vil'nyus and the Institute of Physicotechnical Problems of Power Engineering in Kaunas.

Systems of time-sharing computer centers, which are to service all academic institutions, including the Central Library and its branches, will start work very soon on the basis of BESM-6, BESM-4 and ES-1020 computers after terminals are connected to them. At first the operating speed of each system will be approximately one million operations per second and the operating capacity will reach 1 M bytes. Usually the first course of the work will have a research character. The gains of research will make it possible to proceed to the introduction of another course, for which it is proposed to increase the operating speed of each of the time-sharing computer centers to 2 million operations per second, and the main memory to 4 M bytes.

Each system of a time-sharing computer center includes, besides computers, communication channels of various kinds, such as the telegraph, telephone and special broad-band lines, and terminals of various types -- teletypes, alphanumeric and graphic displays and mini-computers, instruments for the input and output of data of transmitting apparatus, and also controls. To automate the work it is planned to place in serviced institutes terminals with various productivities -- from ordinary teletypes to mini-computers.

The problem of creating time-sharing computer centers for whole groups of institutes with different profiles and of controlling their uninterrupted work has not yet been finally solved; therefore it was introduced into the plan of the tenth five-year period under the title "Automation of scientific research."

This problem of the AS Lithuanian SSR is becoming one of the most complex programs with a scientific and technological profile; all the academic institutes will participate in its solution. Since the program embraces the work of two collective centers or systems which include a number of subsystems, then in accordance with the planned program the institutes of Physics and Mathematics and of Physicotechnical Problems of Power Engineering are working on problems of the general structure of the system and the general structure of the program servicing, are organizing the programs for the servicing of signal transformation and studying the possibilities of expanding data input, etc. Simultaneously in other institutes packets of programs with individual subsystems are being worked out, for example, with the processing of spectral data obtained from spectrometers of various types (NMR, NGR, infrared, ultraviolet, χ , etc). automation of study of the properties of semiconducting materials, automation of the monitoring of contamination of the atmosphere, automation of investigations of the kinetics of chemical reactions, automation of the photometry of comets and other celestial bodies, automation of dendroclimatochronological and botanical investigations, etc.

To manage and coordinate work done within the framework of that program, under the presidium of the academy a special Commission for Computer Technology has been formed which includes highly qualified scientists headed by the academic secretary of the Department of Physicotechnical and Mathematical Sciences V. A. Statulyavichyus and the Scientific Council for Automation of Research, headed by Corresponding Member of the AS Lithuanian SSR A. A. Nemura. Both of these agencies promote the activity of all working groups in automation created in each institute. The scientific council organizes special seminars, lectures and informational services on the state of automation of scientific work both in our country and abroad for workers of the institutes.

Still another characteristics of the plan for the tenth five-year period is the continuity of basic and applied research on many problems. It is assured by the purposeful selection of themes or problems which proceed directly from basic research to applied research and research developments. Such planning and simultaneous complex conducting of basic and applied research connected with a single problem have completely justified themselves in the Institute of Chemistry and Chemical Engineering. In essence, two problems are being worked on there: a theoretical -- the theory of electrodeposition of metals from aqueous solutions -- and an applied -- the development of methods of galvanic coating with predetermined properties. In the study of individual metals -- copper, nickel, cobalt, zinc, lead and many others -- the main questions which flow from the two named problems and relate to the same metal are combined into a single complex theme on which a large group of scientists is working. Some are studying the mechanism and kinetics of electrode processes under working conditions and in electrolytes of different composition, others the character and mechanism of electrocrystallization, the crystalline structure, purity and physicochemical properties of electrodepositions and, finally, still others are searching for the optimal conditions for obtaining galvanic coatings with predetermined properties.

The described complex method of realization of scientific ideas and planned scientific and technological tasks has made it possible for the Institute of

Chemistry and Chemical Engineering of the AS Lithuanian SSR to create during the ninth five-year period alone more than 30 new galvanic technological processes and develop improved technologies which are not inferior in quality of the obtained protective and decorative coatings to the best foreign patents. An overwhelming majority of those processes and technologies have already been introduced at hundreds of plants of different ministries and are giving an annual saving amounting to several million rubles, almost half of it in foreign exchange. With consideration of the described practice not only the themes of the Institute of Chemistry and Chemical Engineering have been constructed according to such principles for 1975-1980, but also a number of problems worked out by other institutes.

Thus, in the scientific direction "Mathematical problems of cybernetics" a single approach is being developed in the Institute of Physics and Mathematics to optimality problems in games theory, and a method of approximation of discrete processes of optimal control of continuous analogs. Simultaneously, on the basis of results of theoretical investigations, practical problems are being solved, for example, designation of the boundaries of lunar signals and interference, analysis of rhythmograms to evaluate the functional state of the heart, improvement of technical means of oral communication, and new methods of studying physiological sleep on the basis of study of the electrical activity of the brain -- by encephalograms, etc.

Similar examples can also be presented in a number of other directions. Thus, in work on the large program "Physics and chemistry of semiconductors" fine fundamental investigations of hot electrons, plasma and jet instabilities, band structure and thin semiconducting films are used. Simultaneously, on the basis of data obtained in theoretical investigations, research and development will be carried out on the creation of new instrument and apparatus -- semiconductor detectors of large vhf power, magnetoresistive sensors, converters of the hf range and other magnetoplasma instruments. Also in that case the two problems, the theoretical and the applied, are combined into a single purposeful complex of coordinated investigations.

On the whole it should be recalled that the planning of the complex continuous development of most major problems -- from basic research to practical results -- contributes to the five-year plan elements of predictability, perhaps even less probability. At the same time such planning greatly increases the proportion of scientific-technological themes. Thus, in the overall plan of work of the academy for the tenth five-year period it amounts to over 45%. In the ninth five-year period its share reached only 23.5%. We suppose that such a proportion of scientific-technological or applied themes is almost the maximum for academic institutes with a profile in the natural sciences or humanities, all the more so as that figure is the average for the academy. In fact, in some experimental institutes the proportion of scientific-technological themes together with state-contract work reaches 60%. One can agree with that, only considering the enormous practical tasks in the acceleration of technological progress.

As is well-known, upon instructions of the Central Committee of the party and the government the academic institutes together with ministries and departments prepared a draft of the Complex Program of scientific and technological progress and its socio-economic consequences for the period 1976-1990. The AS Lithuanian SSR prepared similar programs on the scale of the republic which are now being refined.

The need to conduct investigations by the coordinated efforts of institutes of the AS USSR, the republican academies of sciences and other scientific and production institutions of the country in accordance with urgent large-scale complex programs was emphasized by the session of the general meeting of the AS USSR held on 31 May and 1 June 1976. After discussing summaries of the 25th CPSU Congress and the tasks of the AS USSR, the session in its resolution ordered the departments of sciences of the AS USSR to develop such complex programs and draw all the scientific forces of the country into their coordinated implementation.

Since the all-union programs were still in the stage of development and coordination, the presidium of the AS Lithuanian SSR decided to include in its plan for the tenth five-year period a number of such complex programs for the most part of regional importance. We have already mentioned one of them in discussing the automation of research and the creation in the system of the academy of two time-sharing computer centers.

Still another large international complex program of long-range research is "Man and the biosphere." Participating in its development is a large number of scientific institutions of our country, especially the AS USSR and the academies of sciences of the union republics, and also of many foreign countries. A Soviet committee headed by Academician V. Ye. Sokolov was created in 1975 to coordinate work on that program on an all-union scale.

Although in our republic in accordance with the international and all-union program "Man and the biosphere" questions will be studied which in the main do not go beyond the borders of the Lithuanian SSR, their range is so broad that they can be completely embraced and successfully developed only by the efforts of many collectives. The scientists of the republic will study such questions as the ecological effect of different kinds of earth use and economic activity on the forest landscape, the ecological effect of human activity on meadows, swamps, lakes, rivers, bodies of water and the natural resources of deltas and coasts, ecological evaluation of the use of mineral fertilizers and pesticides, the influence on man and the environment of major engineering and technical structures, the effect of radiation and chemical contaminations of the environment on the genetic apparatus of the cell and organisms, including man and populations, etc. Investigations will be conducted in a total of 14 sections of the overall program.

Drawn into this are the Institute of Economics, all experimental institutions with an agricultural profile, the institutes of geology, the forest, hydraulic engineering and land improvements, a number of institutes with a medical profile and almost all VUZ's of the republic, the republican Committee for Natural Conservation and a number of other organizations. Management of the execution

of separate sections of the program is entrusted to 14 outstanding specialists. To coordinate work and constantly maintain business relations with the Soviet committee for the program "Man and the biosphere" a republican committee has been formed under the presidium of the AS Lithuanian SSR. It consists of 21 scientists and is headed by the academic secretary of the Department of Chemical Technological and Biological Sciences, full member of the AS Lithuanian SSR L. A. Kayryukshtis.

Of the complex programs one should also mention the coordinated development of a large group of questions deriving from the construction in the republic of a large atomic electric power plant near Lake Drukshyay. The construction of the station and the foreseen organization in the course of the tenth five-year period of 1.5 million kilowatts of reactor power advance, together with physical and power engineering problems, many other complex problems. They are, above all, refrigeration, rational use of the heat of ejected waters, precise determination of the hydrothermal and hydrobiological regime in lakes, the removal and disposal of radioactive wastes, protection of the landscape and the environment, etc. Before these problems were worked on in accordance with a single program agreed upon by the State Committee of the Council of Ministers USSR for Use of Atomic Energy, the directorate of atomic power plants, planning organizations and corresponding all-union institutes, 11 republican scientific institutions were drawn in, seven of them academic. Ordered to manage work on the given program and coordinate investigations was the Commission on Questions of Atomic Power Engineering, created under the presidium of the AS Lithuanian SSR and composed of 25 specialists -- workers of science and production -- headed by the vice-president of the academy, Academician of the AS Lithuanian SSR A. A. Zhukauskas.

A large and complex program also is the urgent scientific and technological problem included in the coordination plan of research of the State Committee of the Council of Ministers USSR for Science and Engineering for the tenth five-year period: "Development and introduction of new technological processes methods and automatic equipment for the protection of machines, apparatus and other instruments against corrosion in order to increase their corrosion resistance two or three times." Studies of that problem, coordinated by the Institute of Chemistry and Chemical Engineering of the AS Lithuanian SSR, are conducted in accordance with a single agreed-upon program jointly with the Institute of Physical Chemistry of the AS USSR, the Moscow Institute of Chemical Engineering imeni D. I. Mendeleyev, the Moscow Evening Metallurgical Institute imeni F. E. Dzerzhinskiy, a number of plants of the Ministry of Chemical Industry USSR and the Ministry of Automotive Industry, and some branch institutes and enterprises of the union ministries of machine tool building, heavy machine building, nonferrous metallurgy, light and food industry, and also some plants of republican subordination. A number of themes were included here in the REV [expansion not known] coordination plan and are being worked on by the Institute of Chemistry and Chemical Engineering jointly with corresponding institutes of Bulgaria, Romania, East Germany and Czechoslovakia in accordance with agreements on collaboration.

One could name many more important problems and directions with the character of complex programs (perhaps not so clearly coordinated) and are being worked

on jointly with institutes of the AS USSR and the union republics, and VUZ's and scientific institutions of our republic. They include, for example, probability theory and mathematical statistics, the physics and chemistry of semiconductors, questions of heat exchange and high temperature materials connected with the creation of mhd generators of different types and for different purposes, the scientific principles and measures for the complex and effective use in the national economy of the country of water resources and their protection against contamination, rational economics and the rational socio-economic development of the country to the year 2000, and the joint preparation by institutes of the AS of the Lithuanian, Latvian and Estonian SSR and the Institute of History of the USSR of the AS USSR of the regional work "Istoriya narodiv prybaltiyskykh respublic SRSR z naydavnishykh chasiv do nashykh dniv" [History of the Nations of the Baltic Republics of the USSR from the Oldest Times to Our Day], etc.

Therefore the adopted measures to organize a small number of purposely selected main directions, intensify work and accelerate the introduction of scientific results into the practice of communist construction have created favorable conditions for the successful accomplishment of the tasks set by the October 1976 plenum of the CC CPSU and stated in the speech of Comrade L. I. Brezhnev at that plenum. The second year of the tenth five-year period was greeted by the academy not only with considerable reinforcements, with much work done in anticipation, and also very well prepared in scientific organizational respects.

In conclusion I will note that the main purpose of the article was to emphasize those aspects in the research plan of the AS Lithuanian SSR for 1976-1980 which distinguish it from similar plans for past periods. Those differences, which are mainly the results of detailed discussion of tasks of the institutes of our academy in the light of the historic decisions of the 25th CPSU Congress, are directed toward intensification of scientific work, increase of the effectiveness of research and a great deal of shortening of the path from the generation of an idea to research development and the introduction of new scientific data into production.

Ordinarily we understand well that increasing the productivity of scientific labor and elevating the role of science in communist construction are continuous processes. Not enough has yet been done in that direction, and it is planned to use far from all the scientific potential of the republic. Attempting to improve the coordination of investigations according to the collective programs and gaining much additional experience, the scientists of our republic will strive to eliminate the mentioned shortcomings in execution of the annual plans. The main thing is that the collective of the academy and all scientists of the republic, inspired by the great tasks presented to Soviet science by the 25th CPSU Congress, are ready to extend their efforts to accomplish their tasks and make a contribution to the nationwide cause.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

SIXTIETH BIRTHDAY OF ACADEMICIAN OF THE AS UKRAINIAN SSR S. I. PEKAR

Kiev VISNYK AKADEMIYI NAUK UKRAYINS'KOYI RSR in Ukrainian No 3, Mar 77 p 96

[Announcement]

[Text]

Academician Solomon Isaakovich Pekar, a Soviet theoretical physicist, is celebrating his 60th birthday on 16 March of this year.

Already in his doctoral dissertation the 24-year old investigator developed the very general nonlinear monopolar theory of rectification, which considerably advanced the understanding of contact phenomena and now is acquiring great importance to science. During the Great Patriotic War S. I. Pekar used his knowledge and acquired experience to develop semiconductor instruments needed by the front.

An especially fruitful period of work of the scientist set in in 1944 after returning to Kiev. He was the first to use the microscopic approach to describe the auto-localized state of the electron, which was called the polaron. This concept later became firmly established in the foundations of solid state theory. Such theoreticians as M. M. Bogolyubov, T. D. Li, R. P. Feynman, etc, participated in the development of the theory of polarons later. Then a scientific school formed in Kiev around S. I. Pekar. He is substantiating and developing the method of effective mass and together with M. F. Deygen and simultaneously with D. Bardin and V. Shokli -- the method of deformation potential.

Of fundamental importance is the cycle of work of the investigator on the theory of excitons and the prediction of additional light waves with a different wave vector than the "ordinary." This work has forced a revision of concepts of light absorption. Now the existence of Pekar additional waves has been demonstrated experimentally.

In 1964 the scientist proposed a special mechanism of electron-phonon coupling and on the basis of it a theory of strengthening of ultrasonics by drift of the current carrier. On the basis of that theory working models of various functional elements of acoustoelectronics were developed which are controlled by an external electric field. Later he pointed out the possibility of a self-stimulated mechanism of radiation by a chemically reacting gas, which in principle makes it possible to convert chemical energy directly into the energy of coherent radiation with a large quantum yield.

S. I. Pekar is an experienced teacher and educator of scientific youth. Having organized and headed in 1944 the theoretical section of the Institute of Physics of the AS Ukrainian SSR, he simultaneously restored and headed the Department of Theoretical Physics of Kiev University. Among the students of S. I. Pekar are members of the republican academies, many doctors and a great many candidates of sciences.

Widely greeting Solomon Isaakovich Pekar on his birthday, the scientific community wishes him creative energy, good health and new achievements in the field of science.

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SEVENTIETH BIRTHDAY OF CORRESPONDING MEMBER OF THE AS UKRAINIAN SSR M. G. KREYN

Kiev VISNYK AKADEMIYI NAUK UKRAYINS'KOYI RSR in Ukrainian No 3, Mar 77 p 97

[Announcement]

[Text]

An eminent mathematician, Corresponding Member of the AS Ukrainian SSR Marko Grigorovich Kreyn, is celebrating his 70th birthday.

After completing graduate studies at the Odessa Institute of Popular Education in 1929 he worked in VUZ's -- the Donetsk Mining Institute, the Odessa Institute of Water Transport Engineers and the Odessa Power Institute.

In 1933-1942 Marko Grigorovich headed a department of Odessa University and a sector of the Institute of Mathematics of Khar'kov State University.

During the Great Patriotic War the scientist headed a department of the Kuybyshev Aviation Institute, and in the postwar years worked in the Institute of Mathematics of the AS Ukrainian SSR as head of the section of functional analysis and algebra and headed a department of the Odessa Civil Engineering Institute.

The scientific activity of M. G. Kreyn, which has lasted over 50 years, embraces various areas of mathematics. His contribution to functional analysis has been especially important. The geometry of cones and convex bodies, the theory of expansions of semirestricted operators, purposes of an operator and the theory of operators in spaces with indefinite metrics, non-self-conjugate operators and the theory of perturbations, the distribution of eigenfunctions and inverse spectral problems -- this is a far from complete list of the areas of functional analysis, in the creation and development of which the ideas and methods of M. G. Kreyn have played a fundamental role.

The results of numerous works (and there are 250 of them) of Marko Grigorovich are used in numerous works published in our country and abroad, not only with a mathematical but also with a physical and an engineering content.

The founder of a well-known school of functional analysis in the Ukraine, the scientist has educated more than one generation of mathematicians, among whom are many doctors and candidates of sciences.

M. I. Kreyn has been elected a member of the American Academy of Arts and Sciences. He also is a member of the National Committee of the USSR on theoretical and applied mechanics and of many mathematical societies, especially the Moscow and the American, and a member of the editorial boards of journals of functional analysis.

The scientific community wishes the scientist good health and new creative achievements.

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